

WHAT IS CLAIMED IS:

- 1 1. A method for correlating a received sequence to
2 known sequences in a communications system, comprising the
3 steps of:
4 providing a plurality of known sequences of values;
5 receiving a sequence of values;
6 producing at least one reusable addend;
7 applying said sequence of values to each known
8 sequence of values of said plurality of known sequences of
9 values to produce respective sets of addends, each set of
10 addends of said respective sets of addends corresponding to
11 a respective known sequence of values of said plurality of
12 known sequences of values and including said at least one
13 reusable addend;
14 determining respective correlation results
15 responsive to said respective sets of addends, each
16 respective correlation result corresponding to a correlation
17 between said sequence of values and a respective known

18 sequence of values of said plurality of known sequences of
19 values; and

20 wherein said each set of addends of said respective
21 sets of addends have been reduced in number utilizing a
22 common subexpression elimination algorithm.

1 2. The method of Claim 1, wherein said each known
2 sequence of values of said plurality of known sequences of
3 values includes a plurality of +1 values and a plurality of
4 -1 values.

1 3. The method of Claim 1, wherein said step of
2 producing at least one reusable addend comprises the step of
3 producing said at least one reusable addend responsive to
4 said sequence of values.

1 4. The method of Claim 1, wherein said each known
2 sequence of values of said plurality of known sequences of
3 values comprises a training sequence.

1 5. The method of Claim 1, wherein said communications
2 system comprises a wireless communications system operating
3 substantially in accordance with the Global System for Mobile
4 Communications (GSM) standard.

1 6. The method of Claim 1, wherein said step of
2 applying said sequence of values to each known sequence of
3 values of said plurality of known sequences of values to
4 produce respective sets of addends comprises the step of
5 applying said sequence of values to said each known sequence
6 of values of said plurality of known sequences of values in
7 a plurality of manipulated correlation equations.

1 7. The method of Claim 1, further comprising the steps
2 of:

3 determining whether said each respective
4 correlation result meets a predetermined criterion; and
5 if so, initiating at least one algorithm for
6 detecting and rejecting a signal associated with said each
7 respective correlation result.

1 8. The method of Claim 1, wherein said step of
2 applying said sequence of values to each known sequence of
3 values of said plurality of known sequences of values to
4 produce respective sets of addends comprises the step of
5 applying said sequence of values at a plurality of offsets
6 to said each known sequence of values of said plurality of
7 known sequences of values.

1 9. A method for correlating a received sequence to a
2 known sequence in a communications system, comprising the
3 steps of:

4 receiving a sequence of values;

5 applying said sequence of values to at least one
6 known sequence of values in a correlation equation, said
7 correlation equation definable as including a sum of products
8 of said sequence of values and said at least one known
9 sequence of values;

10 determining a correlation result of said
11 correlation equation using a sum that is independent of said
12 at least one known sequence of values; and

13 wherein said correlation equation has been
14 manipulated to produce said sum that is independent of said
15 at least one known sequence of values.

1 10. The method of Claim 9, wherein said sum that is
2 independent of said at least one known sequence of values is
3 dependent on said sequence of values and offsets thereof.

1 11. The method of Claim 9, further comprising the step
2 of updating said sum that is independent of said at least one
3 known sequence of values when an offset is being incremented
4 or decremented using no more than two values of said sequence
5 of values.

1 12. A method for correlating a received sequence to a
2 known sequence in a communications system, comprising the
3 steps of:
4 receiving a sequence of values;
5 applying said sequence of values to at least one
6 known sequence of values in a correlation equation, said
7 correlation equation definable as including a sum of products
8 of said sequence of values and said at least one known
9 sequence of values, said at least one known sequence of
10 values including a known number of values and at least two
11 identical subsequences of values;
12 determining a correlation result of said
13 correlation equation using a sum of products whose number of
14 product addends is less than said known number of said known
15 number of values; and
16 wherein said correlation equation has been
17 manipulated such that said number of product addends of said
18 sum of products is less than said known number of said known
19 number of values by eliminating products of one of said at
20 least two identical subsequences of values.

1 13. The method of Claim 12, wherein said number of
2 product addends of said sum of products is less than said
3 known number of said known number of values by a number equal
4 to a length of each of said at least two identical
5 subsequences of values.

1 14. The method of Claim 12, wherein at least one
2 product addend of said number of product addends comprises
3 a multiplication by 1 that requires no mathematical
4 operation.

1 15. A method for correlating a received sequence to
2 known sequences in a communications system, comprising the
3 steps of:

4 providing a first known sequence of values;

5 providing a second known sequence of values;

6 receiving a sequence of values;

7 producing a common addend responsive to said
8 sequence of values;

9 applying said sequence of values to said first
10 known sequence of values at a plurality of offsets to produce
11 a first set of addends, said first set of addends including
12 said common addend;

13 applying said sequence of values to said second
14 known sequence of values at said plurality of offsets to
15 produce a second set of addends, said second set of addends
16 including said common addend;

17 calculating a first correlate based, at least in
18 part, on said first set of addends;

19 calculating a second correlate based, at least in
20 part, on said second set of addends; and

21 wherein said first set of addends and said second
22 set of addends are determined, at least partially, by a
23 common subexpression elimination analysis.

1 16. The method of Claim 15, wherein said step of
2 producing a common addend responsive to said sequence of
3 values further comprises the step of adjusting said common
4 addend responsive to an offset value of said plurality of
5 offsets.

1 17. The method of Claim 16, wherein said step of
2 adjusting said common addend responsive to an offset value
3 of said plurality of offsets further comprises the step of
4 adjusting said common addend by performing only two add or
5 subtract operations when incrementing from a first offset of
6 said plurality of offsets to a second offset of said
7 plurality of offsets.

1 18. The method of Claim 15, wherein said common addend
2 is independent of both said first known sequence of values
3 and said second known sequence of values.

1 19. The method of Claim 15, wherein said step of
2 calculating a first correlate based, at least in part, on
3 said first set of addends comprises the step of calculating
4 a negative of said first correlate if a number of non-zero
5 first-order terms involved in said step of calculating a
6 first correlate based, at least in part, on said first set
7 of addends meets a predetermined criterion.

1 20. The method of Claim 15, further comprising the
2 steps of:

3 creating a plurality of second order terms by
4 combining a respective plurality of at least two values of
5 said sequence of values;

6 adjusting "less than all second order" terms of said
7 plurality of second order terms when incrementing from a
8 first offset of said plurality of offsets to a second offset
9 of said plurality of offsets; and

10 wherein said step of calculating a first correlate¹
11 based, at least in part, on said first set of addends
12 comprises the step of calculating said first correlate¹ based,
13 at least in part, on said plurality of second order terms.

1 21. A method for correlating a received sequence to a
2 known sequence in a communications system, comprising the
3 steps of:

4 receiving a sequence of values;

5 applying said sequence of values to at least one
6 known sequence of values in a correlation equation, said
7 correlation equation definable as including a sum of products
8 of said sequence of values and said at least one known
9 sequence of values; and

10 determining a correlation result of a manipulated
11 version of said correlation equation, said manipulated
12 version of said correlation equation derived from performing
13 at least two of the following modifications:

14 said correlation equation modified so that at
15 least one product of said sum of products of said
16 correlation equation becomes zero;

17 said correlation equation modified to produce
18 a sum that is independent of said at least one known
19 sequence of values;

20 said correlation equation, wherein said at
21 least one known sequence of values includes a known
22 number of values and at least two identical
23 subsequences of values, modified such that a number of
24 product addends of said sum of products of said
25 correlation equation is less than said known number of
26 said known number of values of said at least one known
27 sequence of values by eliminating products
28 corresponding to one of said at least two identical
29 subsequences of values of said at least one known
30 sequence of values;

31 said correlation equation and terms thereof
32 modified so as to eliminate common subexpressions; and

33 said correlation equation modified such that
34 a negative result of said correlation equation is to be
35 calculated.

1 22. The method of Claim 21, further comprising the
2 steps of:

3 determining whether said correlation result meets
4 a predetermined criterion; and

5 if so, initiating at least one algorithm for
6 detecting and rejecting a signal that corresponds to said
7 correlation result that meets said predetermined criterion.

1 23. The method of Claim 21, wherein said communications
2 system comprises a wireless communications system operating
3 substantially in accordance with the Global System for Mobile
4 Communications (GSM) standard.

1 24. The method of Claim 21, wherein:
2 said step of applying said sequence of values to
3 at least one known sequence of values in a correlation
4 equation comprises the step of applying said sequence of
5 values at a plurality of offsets to said at least one known
6 sequence of values in said correlation equation.

1 25. A communication station for correlating a received
2 sequence to a known sequence in a communications system, the
3 communication station comprising:

4 a receiver, said receiver adapted to receive a
5 sequence of values;

6 a processing unit operatively connected to said
7 receiver, said processing unit adapted to apply said sequence
8 of values to at least one known sequence of values in a
9 correlation equation, said correlation equation definable as
10 including a sum of products of said sequence of values and
11 said at least one known sequence of values;

12 said processing unit operable to determine a
13 correlation result of a manipulated version of said
14 correlation equation, said manipulated version of said
15 correlation equation derived as a result of performing at
16 least two of the following modifications:

17 modify said correlation equation so that at
18 least one product of said sum of products of said
19 correlation equation becomes zero;

20 modify said correlation equation to produce
21 a sum that is independent of said at least one known
22 sequence of values;

23 modify said correlation equation, wherein
24 said at least one known sequence of values includes a
25 known number of values and at least two identical
26 subsequences of values, such that a number of product
27 addends of said sum of products is less than said known
28 number of said known number of values by eliminating
29 products corresponding to one of said at least two
30 identical subsequences of values;

31 modify said correlation equation and terms
32 thereof so as to eliminate common subexpressions; and

33 modify said correlation equation such that a
34 negative result of said correlation equation is to be
35 calculated.

1 26. The communication station of Claim 25, wherein said
2 processing unit is further operable to determine whether said
3 correlation result meets a predetermined criterion; and
4 wherein the communication station further comprises
5 means for initiating at least one algorithm for detecting and
6 rejecting a signal that corresponds to said correlation
7 result that meets said predetermined criterion.

1 27. The communication station of Claim 25, wherein said
2 communications system comprises a wireless communications
3 system operating substantially in accordance with the Global
4 System for Mobile Communications (GSM) standard.

1 28. The communication station of Claim 25, further
2 comprising a memory unit operatively connected to said
3 processing unit, said memory unit storing a plurality of
4 known sequences of values.

Alt.

~~Communication~~

1 30. A communication station for correlating a received
2 sequence to a known sequence in a communications system, the
3 communication station comprising:
4 a receiver, said receiver adapted to receive a
5 sequence of values;
6 a memory, said memory storing a plurality of known
7 sequences of values;
8 a processing unit operatively connected to said
9 receiver and said memory, said processing unit programmed to
10 compute a plurality of correlation results between said
11 sequence of values and said plurality of known sequences of
12 values; and
13 wherein said processing unit is configured to
14 compute said plurality of correlation results using a
15 modified correlation equation.

31. The communication station of Claim 30, wherein said modified correlation equation comprises a correlation equation that has been modified, said correlation equation definable as including a sum of products of said sequence of values and a known sequence of values from said plurality of known sequences of values, the modification resulting from performing at least two of the following operations:

modify said correlation equation so that at least one product of said sum of products of said correlation equation becomes zero;

modify said correlation equation to produce a sum that is independent of said known sequence of values;

modify said correlation equation, wherein said known sequence of values includes a known number of values and at least two identical subsequences of values, such that a number of product addends of said sum of products is less than said known number of said known number of values by eliminating products

20 corresponding to one of said at least two identical
21 subsequences of values;

22 modify said correlation equation and terms
23 thereof so as to eliminate common subexpressions; and

24 modify said correlation equation such that a
25 negative result of said correlation equation is to be
26 calculated.

1 32. The communication station of Claim 31, wherein said
2 operations are completed prior to receiving said sequence of
3 values and during a design or initialization phase of the
4 communication station.

1 33. The communication station of Claim 30, wherein the
2 communication station comprises at least one of base station
3 and a mobile terminal.

1 34. The communication station of Claim 30, wherein said
2 processing unit is further programmed to initiate at least
3 one algorithm for detecting and rejecting any signal
4 corresponding to a correlation result of said plurality of
5 correlation results that is greater than a predetermined
6 threshold.

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